

Hospital-level Variability in Mortality during Hospitalizations with ICD-9 Codes for Severe Sepsis/Septic Shock, United States, 2013

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INTRODUCTION

Sepsis remains a leading cause of mortality. Efforts to improve sepsis outcomes focus on early recognition and treatment. However, outcomes may also depend on patient and hospital characteristics. We attempted to describe the variability in mortality for sepsis hospitalizations by hospital and assess if hospital characteristics are plausible factors in explaining this variability.

METHODS

MEDICARE FEE-FOR-SERVICE CLAIMS

All 2013 inpatient administrative claims data for all Medicare fee-for-service (FFS) beneficiaries aged 65 and older were aggregated at the hospital level. Sepsis was identified for each hospitalization by the presence of an explicit code for severe sepsis (995.92) or septic shock (785.52). In-Hospital deaths were identified using discharge status. Claims were used to identify aggregate hospital measures: percentage of sepsis hospitalizations discharged to hospice, aggregate average age, average Gagne score, sepsis volume, and total volume among the FFS Medicare population.

HOSPITAL COST REPORTS

Data from the 2013 Centers for Medicare and Medicaid Services Healthcare Cost Report Information System (HCRIS) were linked to the above claims data to identify hospital bed size, teaching status, location, and case mix index.

INCLUSION

Facilities were included in the analysis if they had over 10 claims with code(s) for severe sepsis or septic shock, successfully matched to the cost report file, and had all data. We included all FFS Medicare claims for 2013 from 2,340 hospitals from across the US.

STATISTICAL ANALYSIS

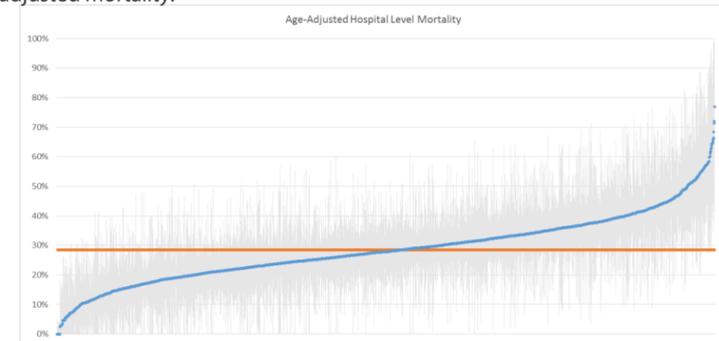
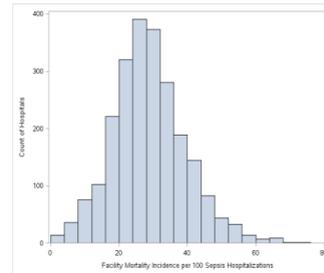
Distribution of crude and age-adjusted in-hospital mortality per 100 sepsis hospitalizations

- Age adjusted mortality was calculated using direct standardization methods based off the total population's age distribution
- Multivariable linear regression with 9 variables was used to quantify how much variability could be explained
- R^2 (the explained variation in the outcome / the total variation) was used to calculate the percentage of variation explained by the variables
- squared partial correlation coefficients were used to explain how much each variable contributed

LARGE VARIATION OF IN-HOSPITAL MORTALITY FOR HOSPITALIZATIONS WITH SEVERE SEPSIS/SEPTIC SHOCK, RANKED BY HOSPITAL

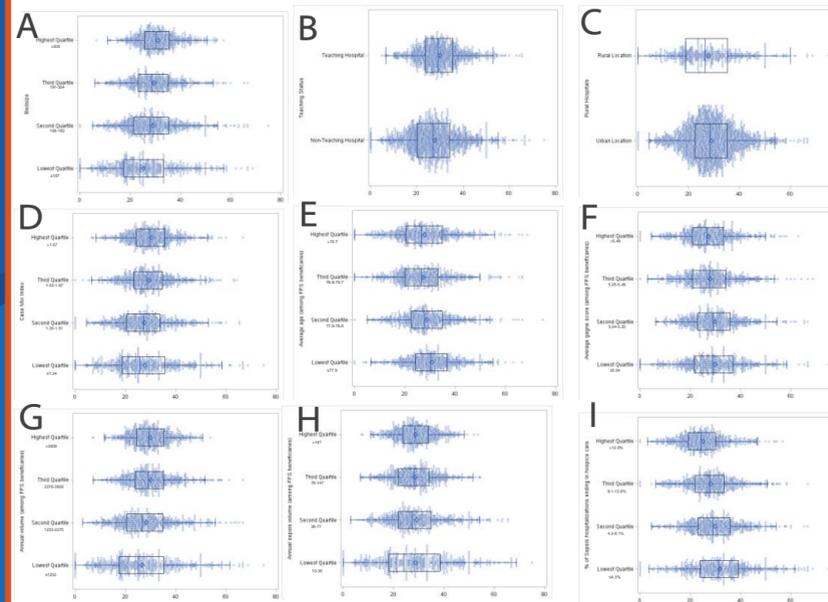
Overall among Medicare beneficiaries, 29% of sepsis hospitalizations resulted in death. By hospital, this ranged from 5-58% (1st-99th percentile)

Right: Distribution of the % of sepsis hospitalizations that resulted in death, by hospital.
Below: Age-adjusted mortality, ranked from lowest to highest by hospital (each hospital is shown as a point in blue with 95% confidence intervals in gray). Orange represents the overall age adjusted mortality.

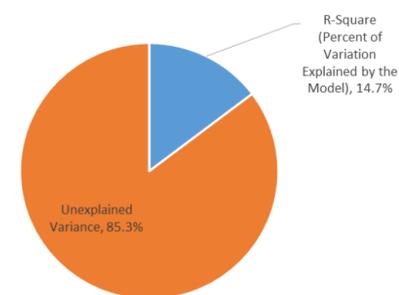


IN-HOSPITAL MORTALITY SIMILAR WHEN STRATIFIED BY HOSPITAL-LEVEL FACTORS

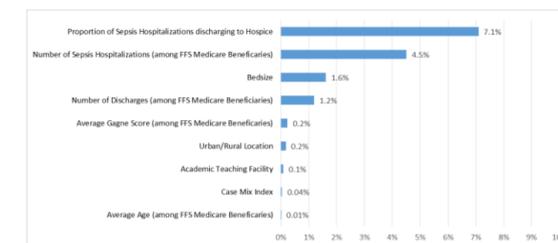
Distribution of the percent of sepsis hospitalizations resulting in death, stratified by several hospital-level factors. All continuous variables broken into quartiles for comparison.
A: Bed size B: Teaching status C: Urban/Rural D: Case Mix Index E: Average Age F: Average Gagne Score G: Annual Volume H: Annual Sepsis Volume I: Percent of sepsis hospitalizations discharged to hospice.



MULTIVARIABLE MODEL EXPLAINED SMALL AMOUNT OF VARIATION (< 15%) OF IN-HOSPITAL MORTALITY



- Multivariable linear regression model included all of the hospital level factors shown in the boxplots above.
- This model explained little (14.7%) of the total variation of in-hospital deaths for sepsis.
- The variable that explained the largest amount of the variation (7%) was the *proportion of sepsis hospitalizations that were discharged to hospice (graph I above)* followed by the *number of sepsis hospitalizations (4.5% of variation, graph H above)*.



CONCLUSIONS

- There was wide variation in the crude and age-adjusted in-hospital sepsis mortality among Medicare (age ≥ 65) beneficiaries for the 2,340 included facilities.
- This variation was not well-explained by several hospital-level factors, assessed crudely (see boxplots) and as a multivariable model.
 - Over 80% of the variation in mortality among hospitals was not explained by the hospital-level variables tested.
 - Among the variables assessed, the percent of sepsis hospitalizations that discharged to hospice care, followed by the sepsis volume explained the highest % of the variation in this model
- As a sub-analysis, we used death within 7 days of hospital discharge as our primary outcome. Increased mortality, with similar variation by hospital was shown (overall: 38% with 1st-99th percentile: 13-68%).
 - A multivariable model with the same variables explained less (10.2%) of the variation
 - In this model, the number of sepsis hospitalizations (sepsis volume) explained the largest amount of variation (5.4%), and the percent of hospitalizations going to hospice was no longer the top predictor.
 - This is consistent with other findings showing that increased volume of sepsis patients in a hospital is a predictor of lower sepsis mortality (Walkey & Weiner, 2014).

DISCUSSION

These data indicate that factors that were not assessed in this study are likely the source for most of the variation in sepsis mortality among hospitals. These factors could include differences in sepsis care quality or practices among hospitals. We are conducting a multi-level analysis to determine the contribution of other patient- and hospital-level factors to observed variability in sepsis mortality and time to death among hospitals.

CONTACT INFO

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